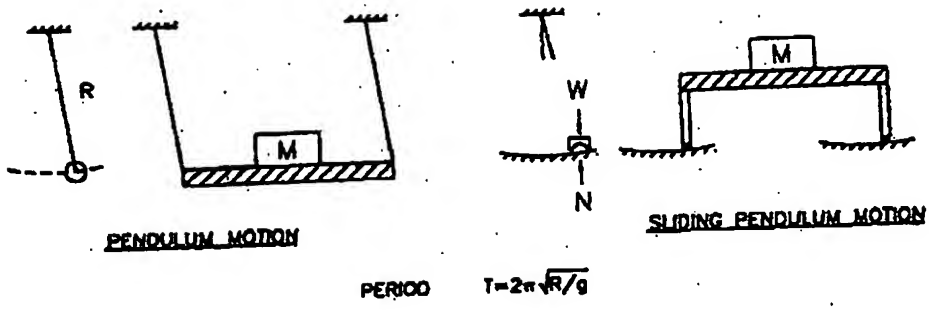

R
M
PENDULUM MOTION
W
N
M
SLIDING PENDULUM MOTION
PERIOD T=2π√R/g

FIG. 1

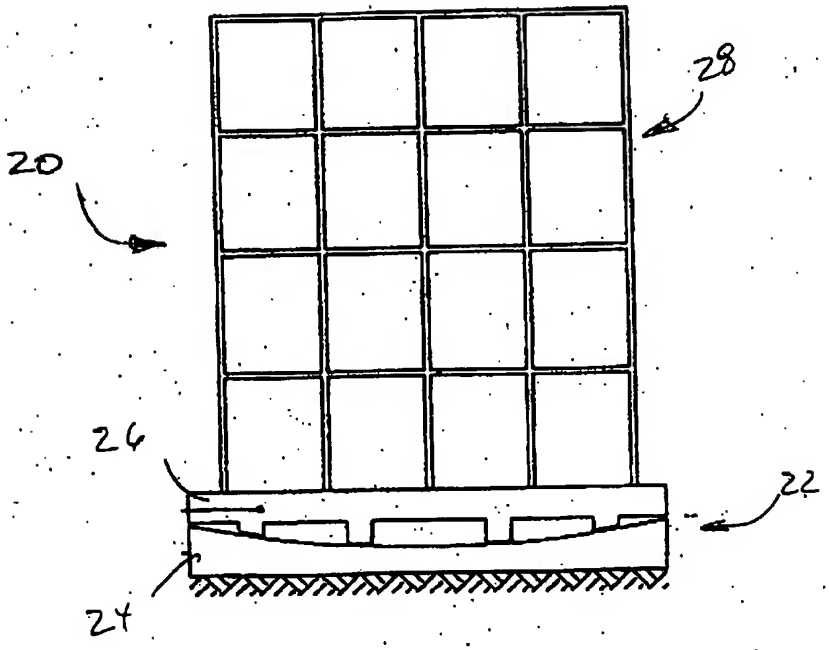

28
20
26
22
24

FIG. 2

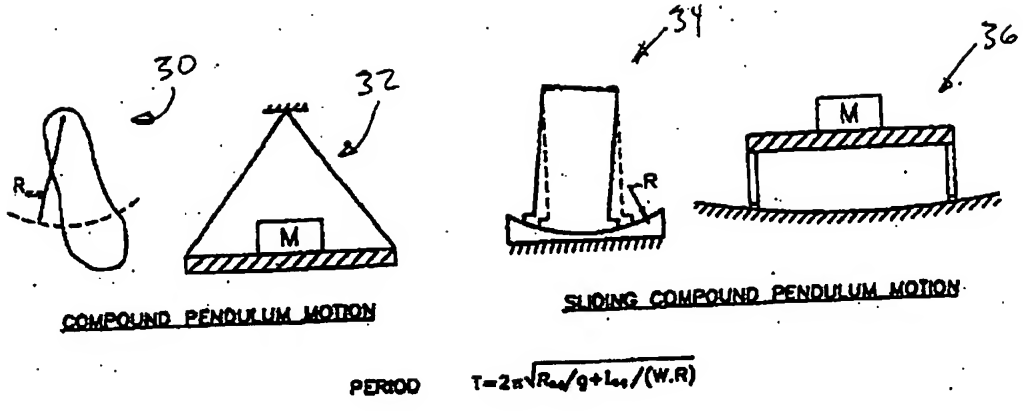

30
32
34
36
M
M
R
R
COMPOUND PENDULUM MOTION
SLIDING COMPOUND PENDULUM MOTION
PERIOD $T=2\pi\sqrt{R_{c.g}/g+L_{c.g}/(W.R)}$

FIG. 3

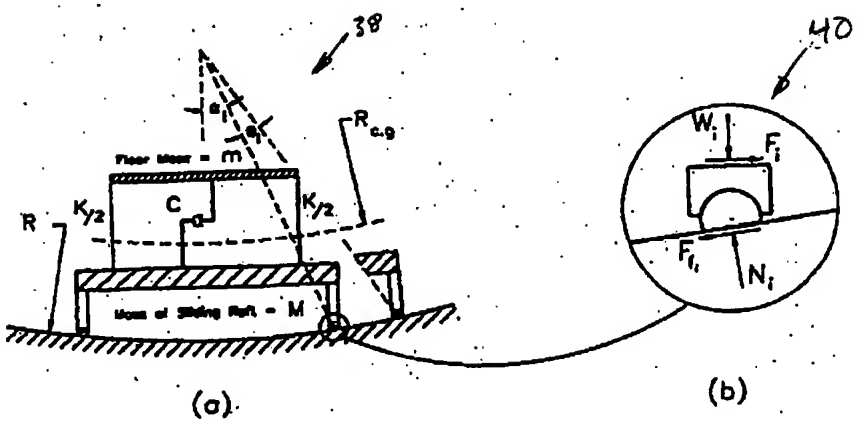
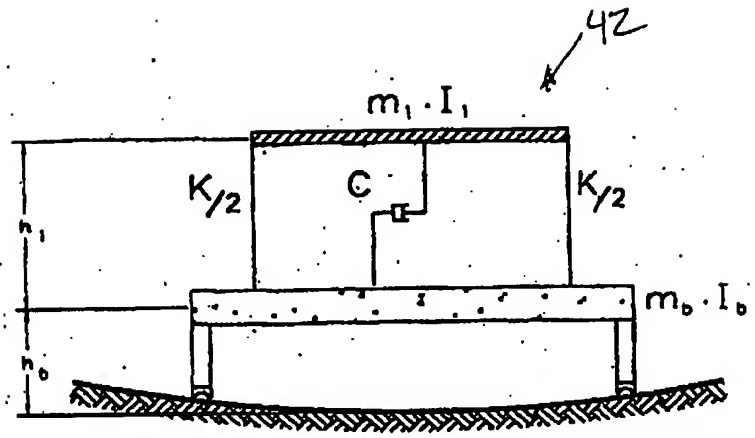

38
40
R
K/2
C
K/2
$R_{c.g}$
m
M
W_i
F_i
F_{f_i}
N_i
(a)
(b)

FIG. 4



m_1	=350.2	kg
I_1	=4109	kg−m^2
m_b	=350.2	kg
I_b	=4109	kg−m^2
K	=8.64x10^4	N/m
C	=550.1	N.sec/m
T	=0.4	sec
R	=15.0	m
h_1	=6.0	m
h_b	=1.0	m
μ	=0.08	
ζ	=0.05	

FIG. 5

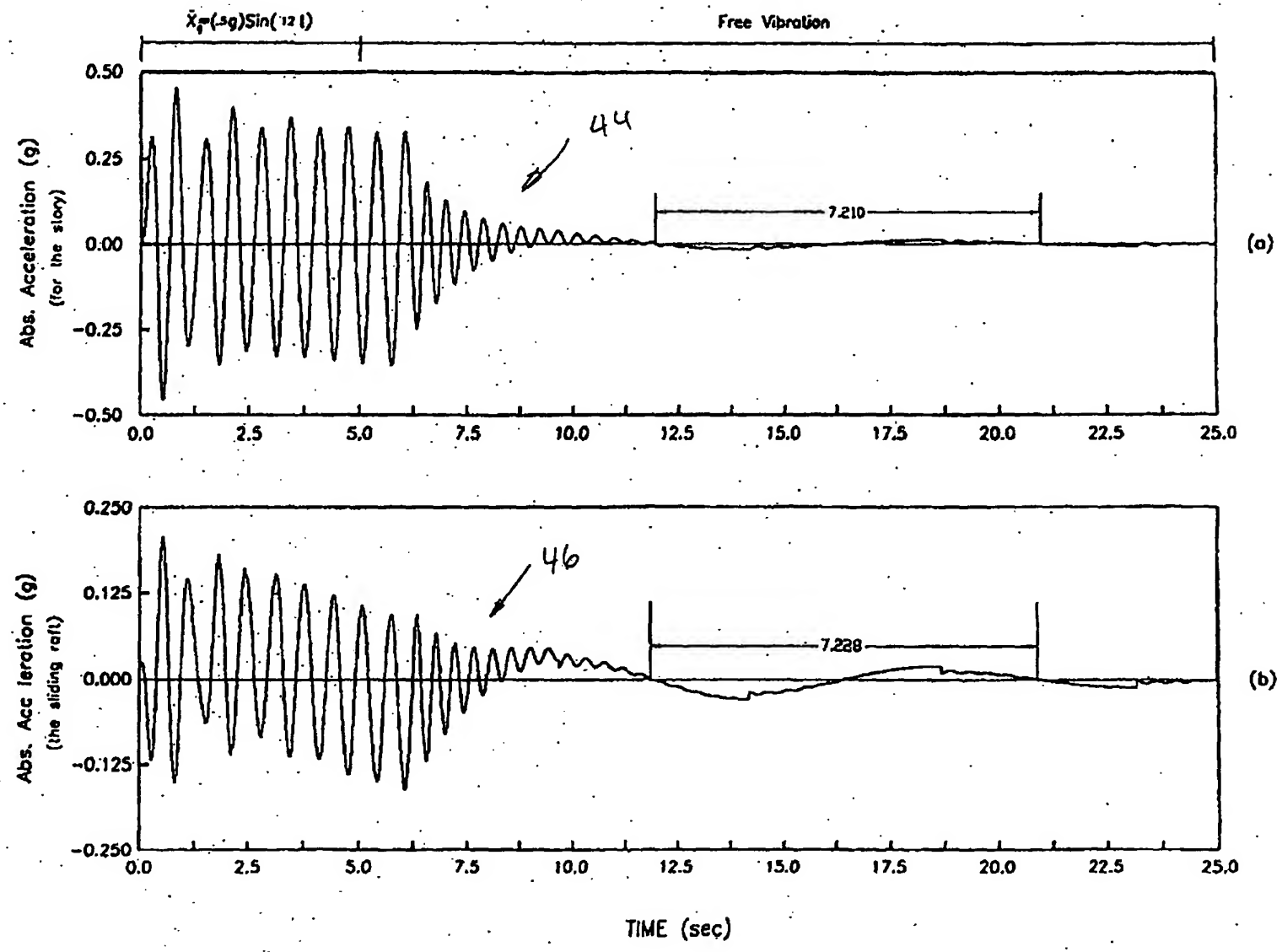
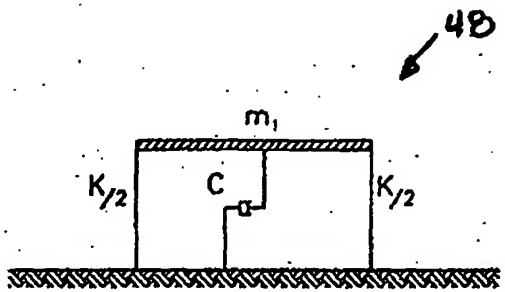
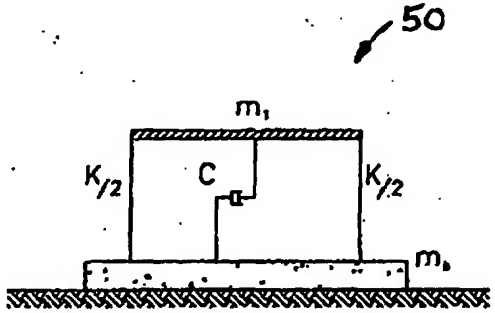

$\ddot{X}_g$=(.5g)Sin(12 t)
Free Vibration
0.50
0.25
0.00
-0.25
-0.50
Abs. Acceleration (g)
(for the story)
44
7.210
(a)
0.250
0.125
0.000
-0.125
-0.250
Abs. Acc leration (g)
(the sliding raft)
46
7.228
(b)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
TIME (sec)

FIG. 6



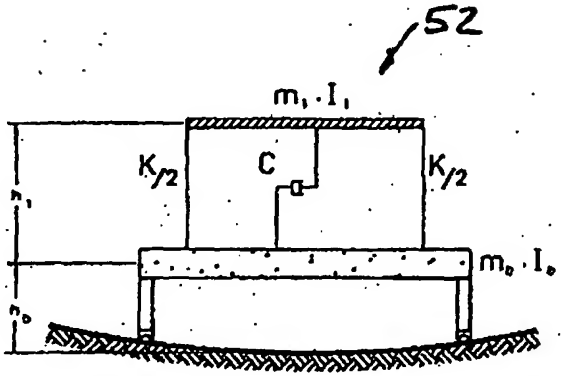
(a)

m_1 = 350.2	kg
K = 8.64×10^4	N/m
C = 550.1	N.sec/m
T = 0.4	sec
ζ = 0.05	



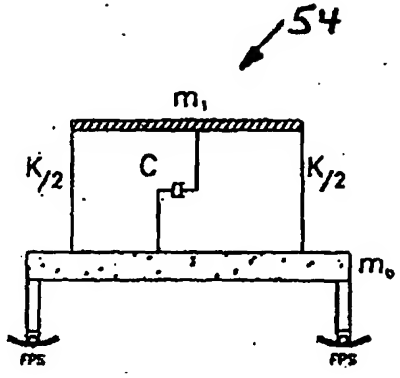
(b)

m_1 = 350.2	kg
m_b = 350.2	kg
K = 8.64×10^4	N/m
C = 550.1	N.sec/m
T = 0.4	sec
μ = 0.08	
ζ = 0.05	



(c)

m_1 = 350.2	kg
I_1 = 4109	kg-m^2
m_b = 350.2	kg
I_b = 4109	kg-m^2
K = 8.64×10^4	N/m
C = 550.1	N.sec/m
T = 0.4	sec
R = 31.0	m
h_1 = 6.0	m
h_b = 1.0	m
μ = 0.08	
ζ = 0.05	



(d)

m_1 = 350.2	kg
m_b = 350.2	kg
K = 8.64×10^4	N/m
C = 550.1	N.sec/m
T = 0.4	sec
R = 1.0	m
μ = 0.08	
ζ = 0.05	

FIG. 7

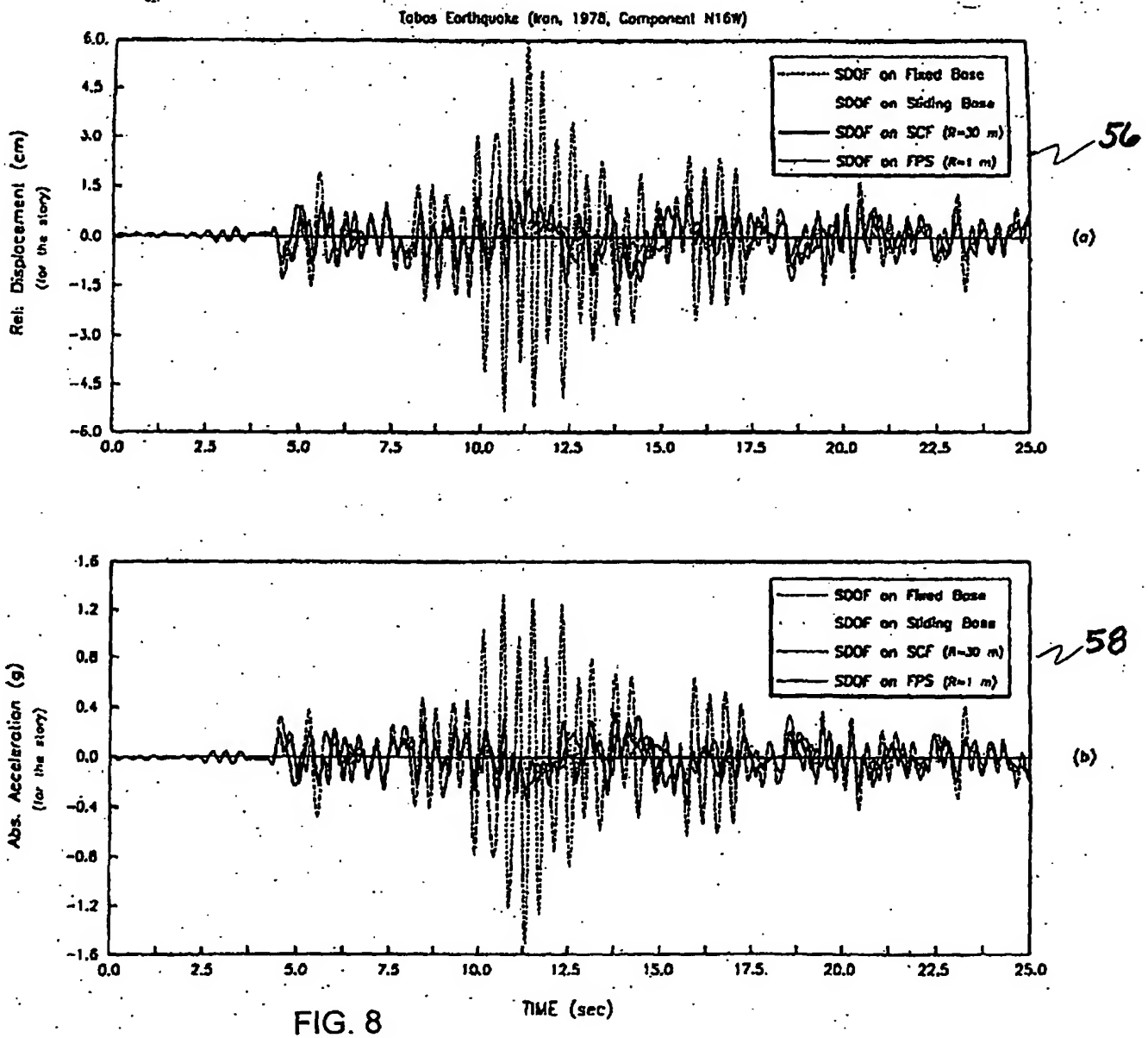

Tabas Earthquake (Iran, 1978, Component N16W)
Rel. Displacement (cm)
(for the story)
SDOF on Fixed Base
SDOF on Sliding Base
SDOF on SCF (R=30 m)
SDOF on FPS (R=1 m)
56
(a)
Abs. Acceleration (g)
(for the story)
58
(b)
TIME (sec)

FIG. 8

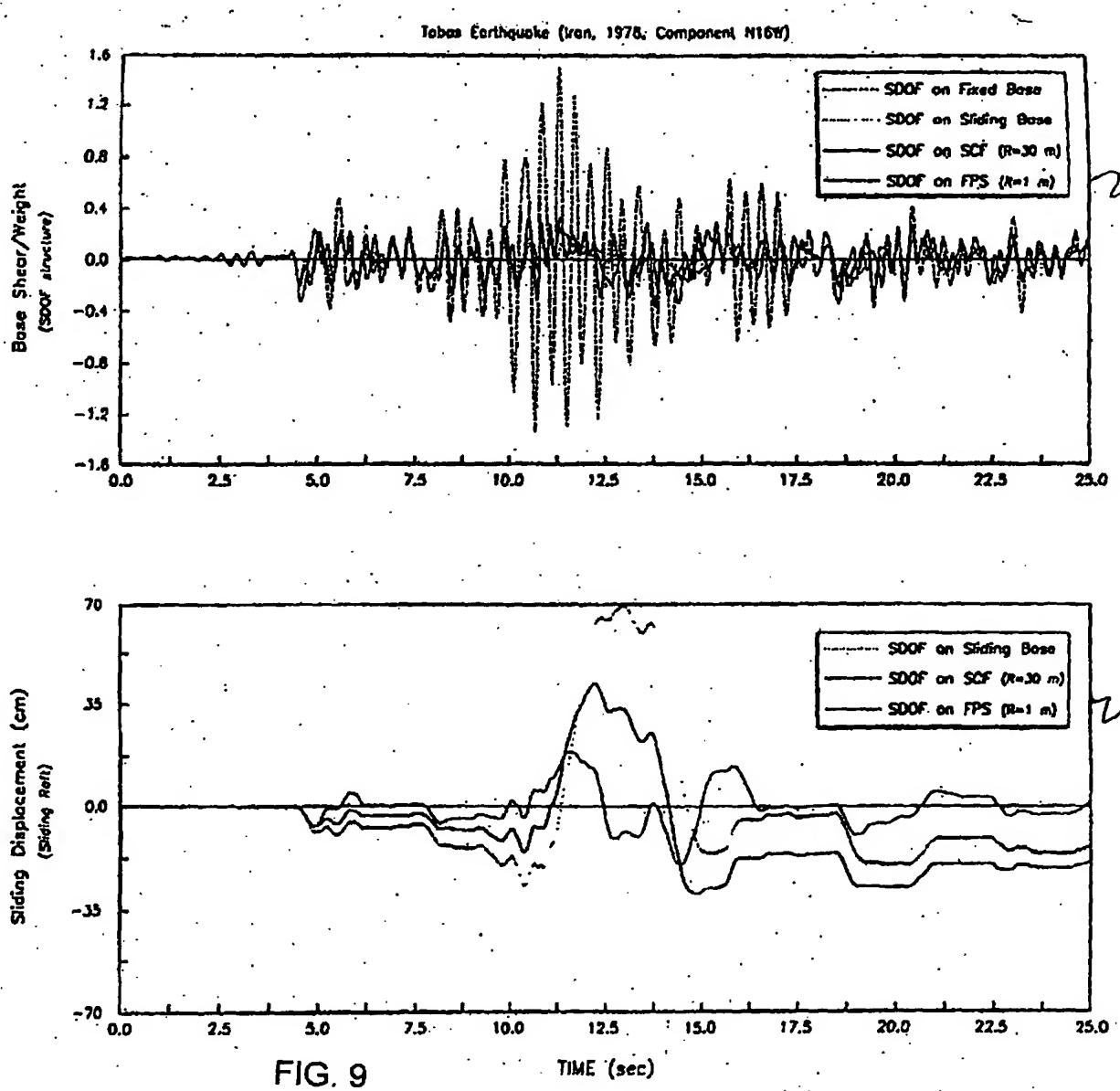

Tabas Earthquake (Iran, 1978; Component N16W)
SDOF on Fixed Base
SDOF on Sliding Base
SDOF on SCF (R=30 m)
SDOF on FPS (R=1 m)
Base Shear/Weight
(SDOF structure)
1.6
1.2
0.8
0.4
0.0
-0.4
-0.8
-1.2
-1.6
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
60
(a)
SDOF on Sliding Base
SDOF on SCF (R=30 m)
SDOF on FPS (R=1 m)
Sliding Displacement (cm)
(Sliding Relt)
70
35
0.0
-35
-70
62
(b)
TIME (sec)

FIG. 9

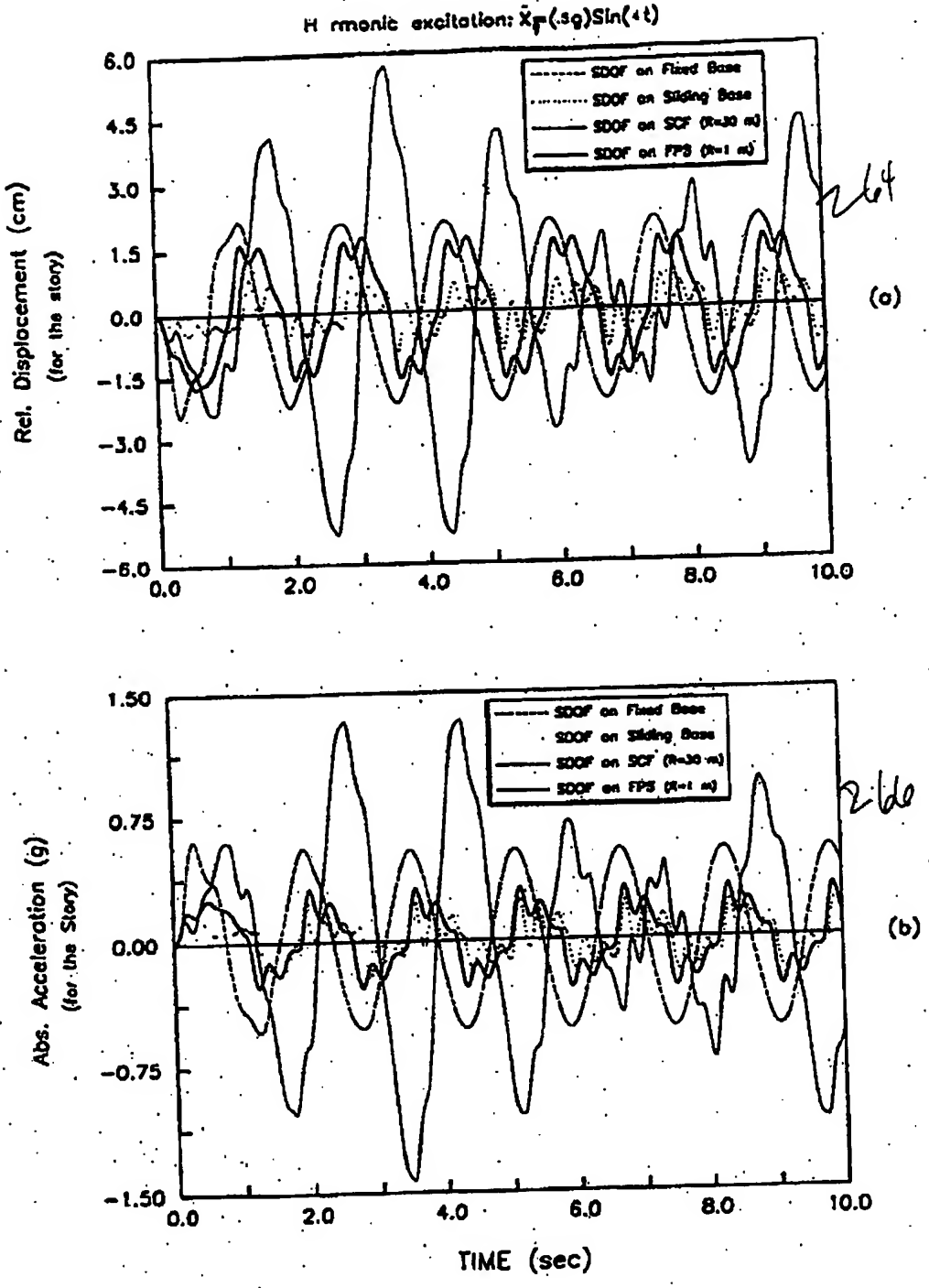

Harmonic excitation: $\ddot{X}_g$(.5g)Sin(4t)
SDOF on Fixed Base
SDOF on Sliding Base
SDOF on SCF (R=30 m)
SDOF on FPS (R=1 m)
Rel. Displacement (cm)
(for the story)
6.0
4.5
3.0
1.5
0.0
-1.5
-3.0
-4.5
-6.0
0.0
2.0
4.0
6.0
8.0
10.0
2.64
(a)
SDOF on Fixed Base
SDOF on Sliding Base
SDOF on SCF (R=30 m)
SDOF on FPS (R=1 m)
Abs. Acceleration (g)
(for the Story)
1.50
0.75
0.00
-0.75
-1.50
0.0
2.0
4.0
6.0
8.0
10.0
2.66
(b)
TIME (sec)

FIG. 10

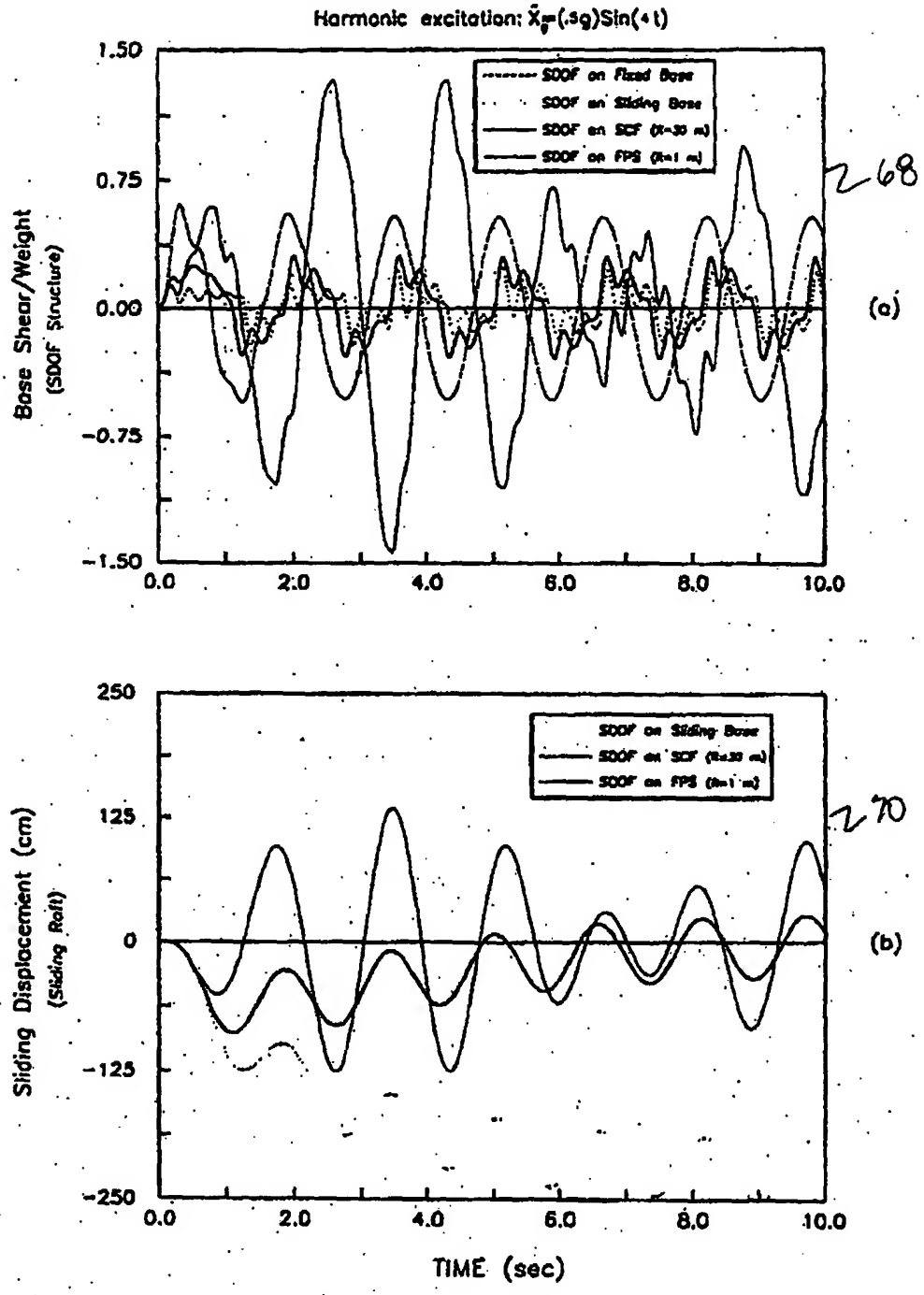

Harmonic excitation: $\ddot{X}_g$=(.3g)Sin(4t)
SDOF on Fixed Base
SDOF on Sliding Base
SDOF on SCF (R=30 m)
SDOF on FPS (R=1 m)
Base Shear/Weight
(SDOF Structure)
1.50
0.75
0.00
-0.75
-1.50
0.0
2.0
4.0
6.0
8.0
10.0
268
(a)
SDOF on Sliding Base
SDOF on SCF (R=30 m)
SDOF on FPS (R=1 m)
Sliding Displacement (cm)
(Sliding Raft)
250
125
0
-125
-250
270
(b)
TIME (sec)

FIG. 11

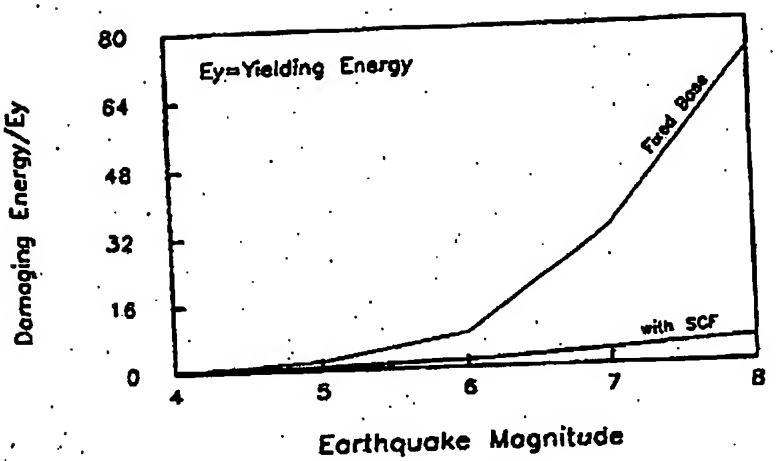

Ey=Yielding Energy
Damaging Energy/Ey
80
64
48
32
16
0
4
5
6
7
8
Earthquake Magnitude
Fixed Base
with SCF

FIG. 12

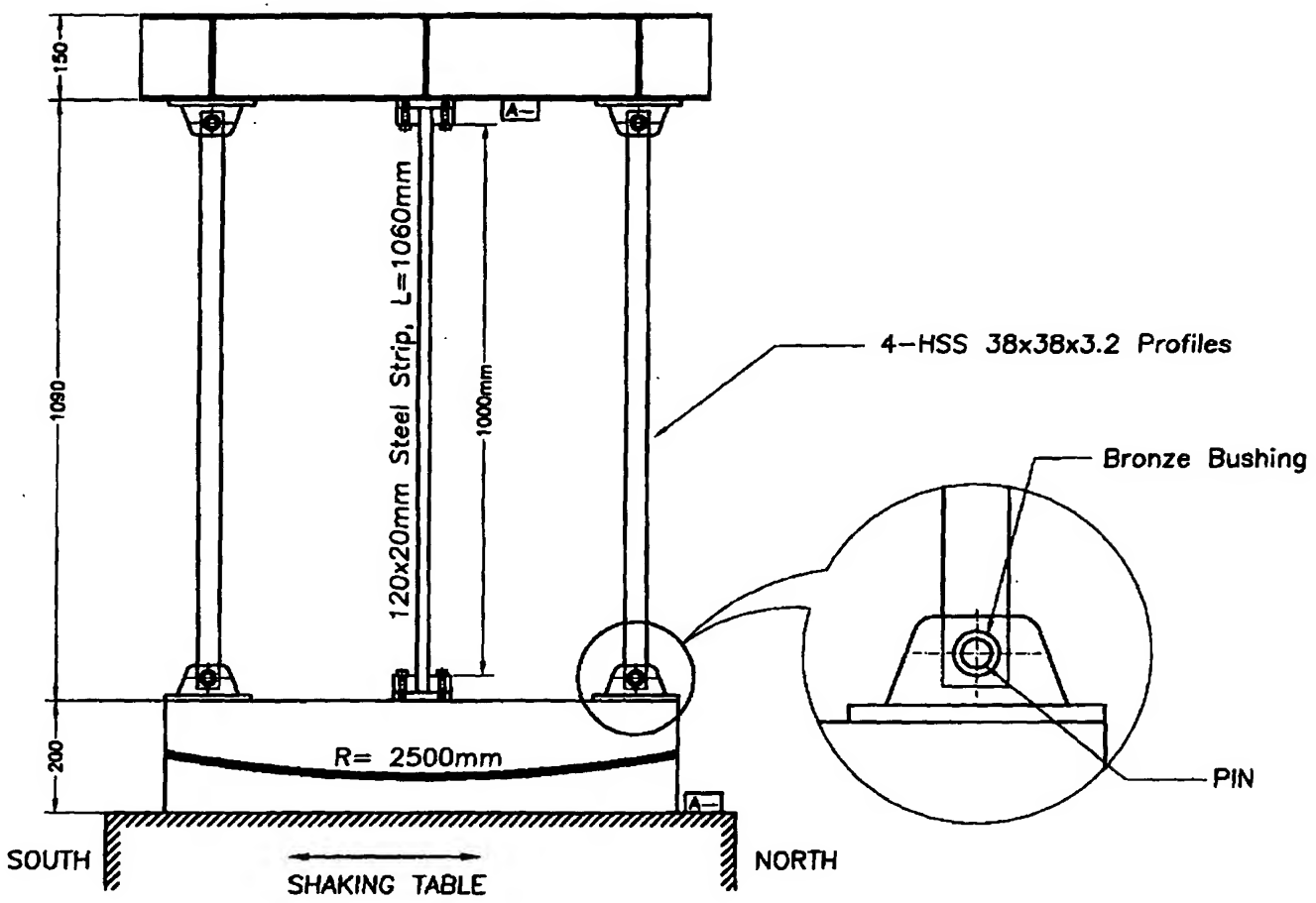

150
1090
200
120x20mm Steel Strip, L=1060mm
1000mm
4-HSS 38x38x3.2 Profiles
Bronze Bushing
PIN
R= 2500mm
SOUTH
NORTH
SHAKING TABLE

Figure 13

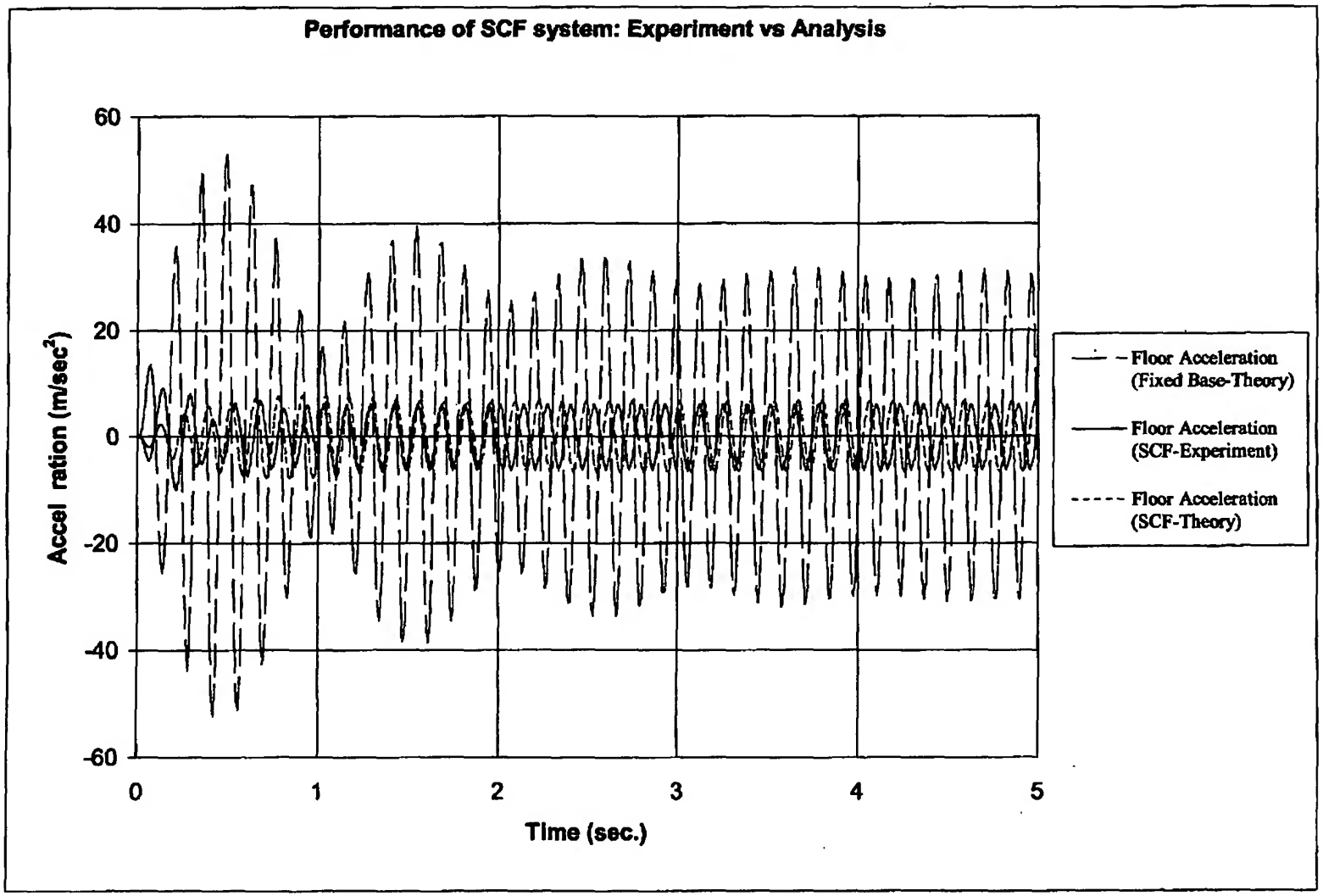

Performance of SCF system: Experiment vs Analysis
60
40
20
0
-20
-40
-60
Accel ration (m/sec²)
0
1
2
3
4
5
Time (sec.)
Floor Acceleration (Fixed Base-Theory)
Floor Acceleration (SCF-Experiment)
Floor Acceleration (SCF-Theory)

FIG. 14